DEFINING THE NOTION OF CONCEPT MAPS 3.0

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DEFINING THE NOTION OF CONCEPT MAPS 3.0

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Web based concept maps can be viewed as reflections of generations of web technology. Thus we define the following generations of concept maps:

Concept maps 1.0

- Contain static content, which must be manually updated either directly in the source code or through an interface.
- Are typically created using desktop tools (CmapTools, VUE).
- Can be exported to web 1.0-formats (GIF, HTML) or XML-formats (CXL).
- Can be embedded in webpages.

Concept maps 2.0

- Can be created using dedicated online / web based tools (Cmap Cloud).
- Utilize social web (web 2.0) technology to facilitate sharing and collaboration.
- Are represented in open standards such as SVG (Scalable Vector Graphics).

Concept maps 3.0

- Utilize semantic web / web of data (web 3.0) technology to make content dynamic.
- Contain semantic metadata in order to make concept maps 3.0 discoverable (search engines can find and process concept maps based on their content).
- Can make use of semantic metadata for meaningful integration of data from external semantic web resources, as well as for alternative visualization of both internal and external data.

Defining Five Fundamental Requirements for Concept Maps 3.0

We have adopted the following *Web Data Principles* (Wilde, E., 2016, http://dret.github.io/webdata/), which outline five recommendations for exposing data on the Web of Data / Semantic Web.

These recommendations state that Web Data should be:

- Linkable
- Parseable
- Understandable
- Linked
- Usable

Based on the Web Data Principles above, we propose five requirements for concept maps 3.0 as data sets:

1. "Concept maps should be linkable, that is accessible via persistent or stable identifiers. This obviously applies to the concept map as a whole but preferably also to its constituent parts. In this way, external resources can point to specific entities or objects in the structure." (Johnsen, L. & Jensen, J., 2016).

   We suggest representing concept maps in SVG (Scalable Vector Graphics), which is an XML (Extensible Markup Language) language for two dimensional graphics that also makes it possible to attach unique identifiers to all the verbo-visual elements that constitute a concept map.

2. "Concept map distributions should be represented in open formats that do not require proprietary software for processing and whose source code is open to inspection." (Johnsen, L. & Jensen, J., 2016).

   SVG can also be utilized to fulfill this requirement of concept maps being parseable, as SVG is a W3C (World Wide Web Consortium) endorsed open format and standard, is supported by browsers, can be embedded in HTML (Hyper Text Markup Language), and can be rendered as part of larger web pages.

3. "Concept maps should be annotated by metadata using "well-known" and/or "well-documented" vocabularies." (Johnsen, L. & Jensen, J., 2016).

   We propose to use schema.org (https://schema.org/) as the main vocabulary to mark up concept maps because it is both well-known, well-documented, and supported by major search engines. This allows concept maps to be understandable, and thus discoverable and conductive to processing. Furthermore, we propose that this schema.org metadata be added to SVG concept maps by using formats such as JSON-LD (JavaScript Object Notation for Linked Data) or RDFa (Resource Description Framework in Attributes).

4. "Concept maps should be linked to other resources to enhance their informational or learning value. Links should be typed if possible to signal their communicational purpose and/or the nature of their target and to enable automatic processing. Individual concepts should be linked to external resources to better determine their identity." (Johnsen, L. & Jensen, J., 2016).

   This can be achieved by providing links to Wikidata entities, which can act as unique identifiers i.e. as pointers referencing web pages, which unambiguously indicate the meaning or identity of some concept.

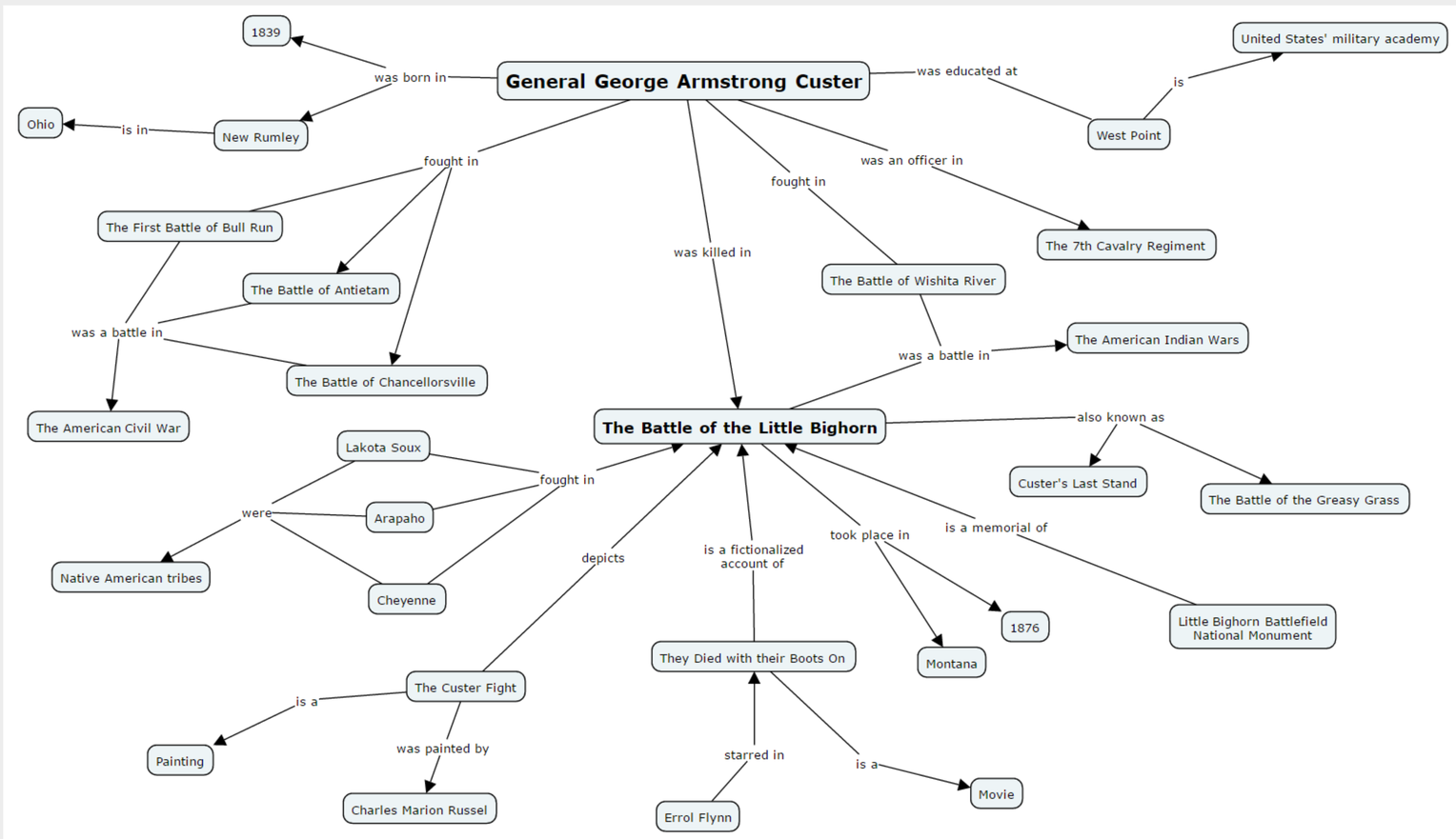
5. "Concept maps should be labeled with a license to signify when, where, how and by whom they may be put to use and under what circumstances." (Johnsen, L. & Jensen, J., 2016).

   This can be achieved by linking to a Creative Commons license, which will allow the concept maps in question to signal how usable they are

References:
Johnsen, L., & Jensen, J. (2016). Towards Concept Maps 3.0: Visual Learning Designs as Web Data. I H. Erdman Thomsen, A. Pareja-Lora, & B. Nistrup Madsen (red.), *Term Bases and Linguistic Linked Open Data: TKE 2016. 12th International Conference on Terminology and Knowledge Engineering.* (s. 236-246). København: Copenhagen Business School.

A simple example of how a concept map 3.0 can be annotated and exposed as web data using the schema.org vocabulary and the format JSON-LD

This particular example includes a snippet of code specifying metadata for a history concept map about the American general George Armstrong Custer




```
<script type="application/ld+json">
{
"@context": "http://schema.org/",
"@type": "CreativeWork",
"learningResourceType" : "concept map",
"inLanguage" : "en",
“license” : “https://creativecommons.org/licenses/by/2.0/”,
"additionalType" : "http://cmap.ihmc.us/xml/CXL.html#cmap",
"name": "Custer",
"url": "https://cmapscloud.ihmc.us/viewer/cmap/1PXQ8ZZHR-22371RZ-16M4BB",
"description/focusQuestion": "What was General George Armstrong Custer famous for?",
"mainEntity" :
{ "@type" : "Person",
"additionalType" : "http://cmap.ihmc.us/xml/CXL.html#concept",
"sameAs" : "https://www.wikidata.org/wiki/Q188205",
"url": "https://cmapscloud.ihmc.us/viewer/cmap/1PXQ8ZZHR-22371RZ-16M4BB#custer",
"name" : "George Armstrong Custer",
"image" :
"https://upload.wikimedia.org/wikipedia/commons/1/16/Custer_Bvt_MG_Geo_A_1865_LC-BH831-365-crop.jpg",
"description" :
{
"@type" : "Role",
"roleName" : "Google's Knowledge Graph",
"description" : "http://g.co/kg/m/0pzgm"
}
},
"about" :
{ "@type" : "Event",
"additionalType" : "http://cmap.ihmc.us/xml/CXL.html#concept",
"sameAs" : "https://www.wikidata.org/wiki/Q205422",
"name" : "The Battle of The Little Bighorn",
"alternateName" : "Custer's Last Stand"}
}
</script>
```

A link specifying that the metadata types and properties used in the code belong to the schema.org vocabulary.

A link to a Creative Commons license signaling how the concept map may be used.

Links to the Wikidata pages about George Armstrong Custer and The Battle of Little Bighorn.